REMARKS

Claims 1-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,106,790 to Hsuing et al.

Hsuing et al. was cited as teaching a cleaning gas including NF_3 (column 4, lines 9-13). The Examiner reads Hsuing et al. as also teaching that the cleaning gas may contain SF_6 and/or F_2 and also includes N_2, O_2, CF_4, C_2F_6, and CHF_3 (citing column 2, lines 61-67) with a 1% NF_3 concentration (column 5, lines 21-22). Although acknowledging that Hsuing et al. fails to teach a cleaning gas containing SF_6 in an amount of about 0.4-4.5 volume % and an inert gas in an amount of from 0.01 to 500 in terms of volume ratio, the Examiner considered Hsuing et al. as teaching the grouping of CHF_3 and SF_6 as fluorocarbons used for similar purposes in a semiconductor lab (citing column 4, lines 12-14) and further teaching a feed (gas) comprising 3 weight % CHF_3 (citing column 5, lines 55-56).

The reason for rejection was that it would have been obvious to provide (a cleaning gas) containing 3 weight % SF_6 because both (SF_6 and CHF_3) are used for similar purposes (citing column 4, lines 12-14).

Applicants traverse, and respectfully request the Examiner to reconsider for the following reasons.

The Invention:

As claimed in present claim 1, the invention is directed to a cleaning gas for removing deposits in semiconductor production equipment. The cleaning gas comprises an inert gas and at least two gases selected from SF_6, F_2 and NF_3 excluding the combination of F_2 and NF_3 alone. The cleaning gas contains SF_6 in an amount of about 0.4-4.5 vol %. Furthermore, F_2 and/or NF_3

is from 0.01 to 5 and the inert gas is from 0.01 to 500 in terms of the volume ratio assuming that SF_6 is 1.

Hsuing et al.:

Turning to the cited prior art, Hsuing et al. surely teaches a cleaning gas containing NF_3 for use in cleaning CVD reactor chambers (column 4, lines 9-12). The Examiner then goes on to assert that Hsuing et al. teaches that the cleaning gas may also contain SF_6 and/or F_2 and also a plurality of other gases (citing column 2, lines 61-62) including a 1 % NF_3 concentration (citing column 5, lines 21-22). However, it is respectfully submitted that the Examiner mischaracterizes the reference and reads passages out of context.

Particularly, the passage at column 2, lines 61-67 describes a typical waste gas containing NF_3 and a host of other components ordinarily collected and combined from the various unit operations in a semiconductor fabrication facility. Note, for example, the passage at column 4, lines 13-16 which describes that the FC consumption in the manufacturing processes (plural) is usually not complete, such that the exhaust stream will contain a mixture of FCs. Nowhere does Hsuing et al. teach, suggest, describe or disclose a cleaning gas as a single unit operation containing the large number of components described at column 2, lines 61-66, and in fact such cleaning gas does not exist. Rather, after collecting the exhaust from many unit operations using different gases, the object of Hsuing et al. is to selectively destroy NF_3 so as to allow for recovery of other components. Note also that the passage at column 4, lines 12-13 describes that other FCs, such as CF_4, C_2F_6, etc., are used in the semiconductor fabs for similar purposes. This

passage does not say that these other FCs are used in combination with NF_3, but rather teaches to the contrary.

Example 1 of Hsuing et al. cited by the Examiner describes treatment of a feed containing 1 % NF_3 and nitrogen with a fluidized iron powder bed so as to evaluate NF_3 conversion. This has nothing to do with a cleaning gas, and also has nothing to do with an exhaust gas other than possibly suggesting that a typical exhaust gas might contain 1 % NF_3.

No Motivation to Substitute SF_6 for CHF_3:

The Examiner cites Hsuing et al. as teaching that both CHF_3 and SF_6 are fluorocarbons that can be used for similar purposes in a semiconductor lab, citing column 4, lines 12-14, and further cites Hsuing et al. as teaching a feed comprising 3 weight % CHF_3, citing column 5, lines 55-56. The Examiner then goes to conclude that it would have been obvious to substitute SF_6 in the feed containing 3 weight % CHF_3 because both CHF_3 and SF_6 are used for similar purposes.

Applicants respectfully disagree. The feed of Example 3 containing 3 weight % CHF_3 is not an etching gas or a cleaning gas, but rather attempts to simulate a waste stream. As described bridging columns 5-6, because CHF_3 is the most reactive of the four FCs used in the electronics industry, CHF_3 was added to the test waste stream (called a "feedstock" in Example 3) to confirm that NF_3 was selectively destroyed without converting CHF_3. As described at column 5, line 62, "no CHF_3 conversion was observed".

Perhaps the Examiner considered that claim 1 reads on Example 3 of Hsuing et al. when SF_6 is substituted for CHF_3 in the waste gas. Although Example 3 employed the same type of iron powder loaded in the same reactor as described in Example 1, nowhere does Example 3

disclose that the same feed gas of Example 1 containing NF_3 was used. To the contrary, Example 3 describes that the challenging feed stock "contained a nominal 3 weight % CHF_3" and there is no mention of NF_3. Aside from the above, Example 3 was a test to determine whether the most reactive of FCs would be converted in the reactor. This was not a test of etching rate or any other unit operation in a semiconductor fabrication, and thus there is no motivation or reason to even consider substituting SF_6 for the CHF_3. Hsuing et al. wanted to know whether the most reactive of FCs would be converted in the reactor, and was not interested in less reactive SF_6.

Nothing to Optimize:

Lastly, the Examiner considered that it would have been obvious to optimize FCs because "discovering an optimum value or a result effective variable involves only routine skill in the art". However, there is simply nothing to optimize in Hsuing et al. The idea in Hsuing et al. is to convert NF_3 without converting FCs. See column 4, lines 7-9 (a further objective of this invention is to selectively destroy NF_3 in the presence of other fluorinated compounds (FCs)) and the disclosure at column 4, lines 18-19 (the semiconductor industry prefers the option of reclaiming and recycling the FCs for reuse). Regardless of the amount of FCs in the waste stream, the object of Hsuing et al. is to selectively destroy the NF_3 without converting FCs. The exhaust gas can contain as much or as little FCs as is produced by the various unit operations in the semiconductor facility.

In summary, Hsuing et al. teaches a process for destroying NF_3 in a gas comprising NF_3, N_2, O_2, F_2, CF_4, CHF_3, SF_6 and C_2F_6 by contacting the gas with metal particles capable of reacting with NF_3. The gas described therein is a typical waste gas containing NF_3 and other

components ordinarily collected in a semiconductor fabrication facility, and is NOT a cleaning gas.

That is, Hsuing et al. discloses a waste gas, namely, a gas to be treated, while the mixed gas of the present invention is a cleaning gas. Not only does Hsuing et al. fail to describe the claimed cleaning gas, because it concerns a waste gas, there is nothing in Hsuing et al. which would suggest the desirability of modifying waste gas collected in a semiconductor fabrication facility to arrive at the claimed cleaning gas.

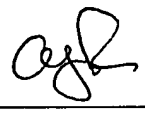
For the above reasons, it is respectfully submitted that the present claims are patentable over Hsuing et al., and withdrawal of the foregoing rejection under 35 U.S.C. § 103(a) is respectfully requested.

Withdrawal of all rejections and allowance of claims 1-22 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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